Characterization of the Last 25 Years of Shoreline Change on the Lake Superior Shoreline

COASTAL EROSION

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Two main purposes

1. To characterize and georeference shoreline change and erosion along the Lake Superior shoreline
   - Identify areas of concern for shoreline users in Douglas, Bayfield, Ashland, and Iron counties
   - Provide WI Coastal Management with an accessible characterization of shoreline
   - Characterize change in beach/nearshore sediment thickness
   - Characterize and analyze bluff profiles for stability and likelihood of failure

And …..

2. Identify useful predictors of future bluff recession rate by relating past recession rate with factors such as lake level, wind and wave history, and nearshore bathymetry

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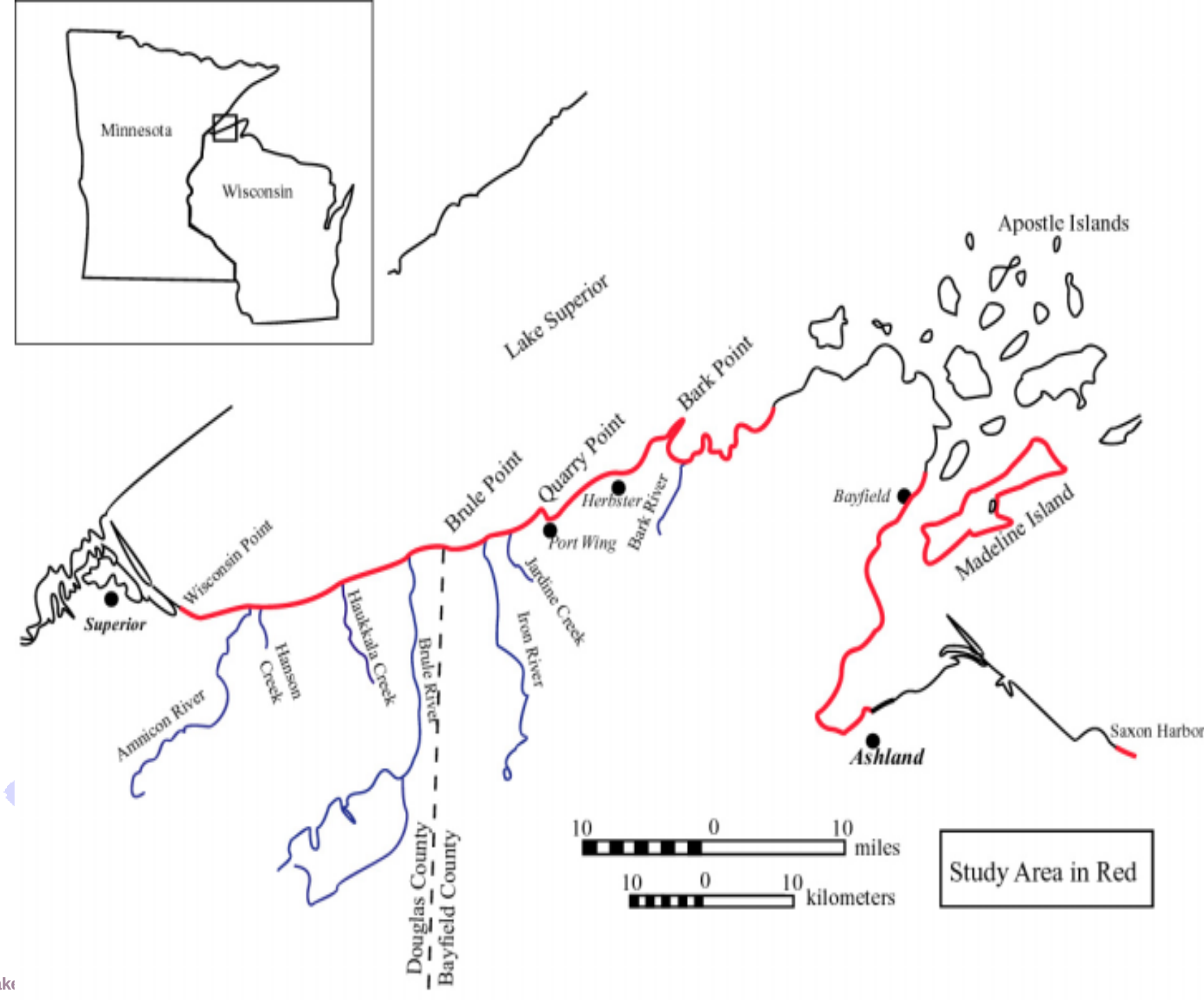


Characterization

- ~125 miles
- Shoreline: ~60% bluff, 15% low beach, 15% bedrock
- Bluffs: average 40 feet high
- Vegetation: trees, low shrubs, weeds
- Thinly populated

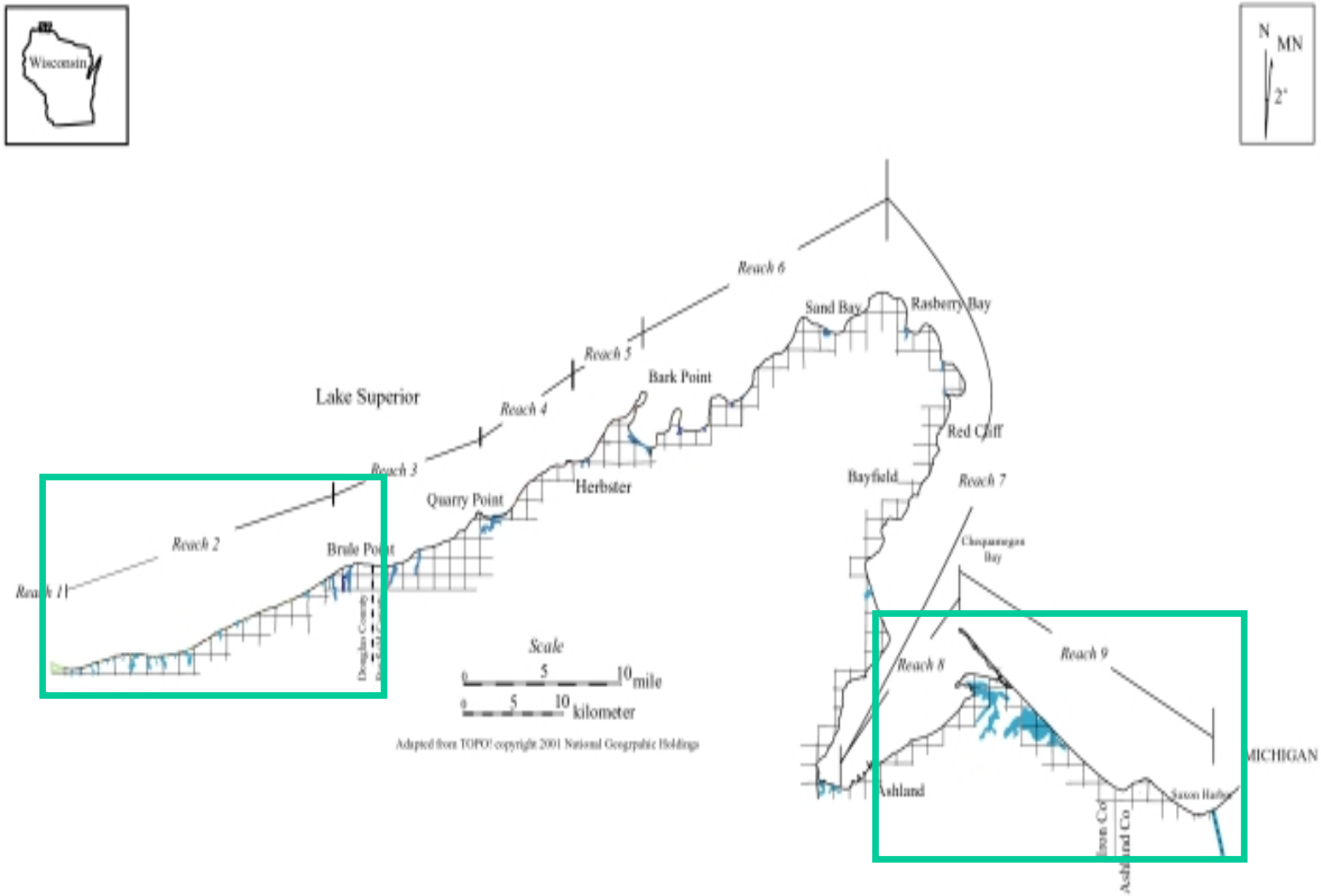
Johnson and Need, 1980

Identified 3 till units

- Douglas: reddish brown, clay till
- Hanson Creek: dark reddish brown, clay till
- Jardine Creek: reddish-brown, slightly stony, sandy loam
- Sandstone bedrock

❖Clay-rich till holds water

Location of Reaches



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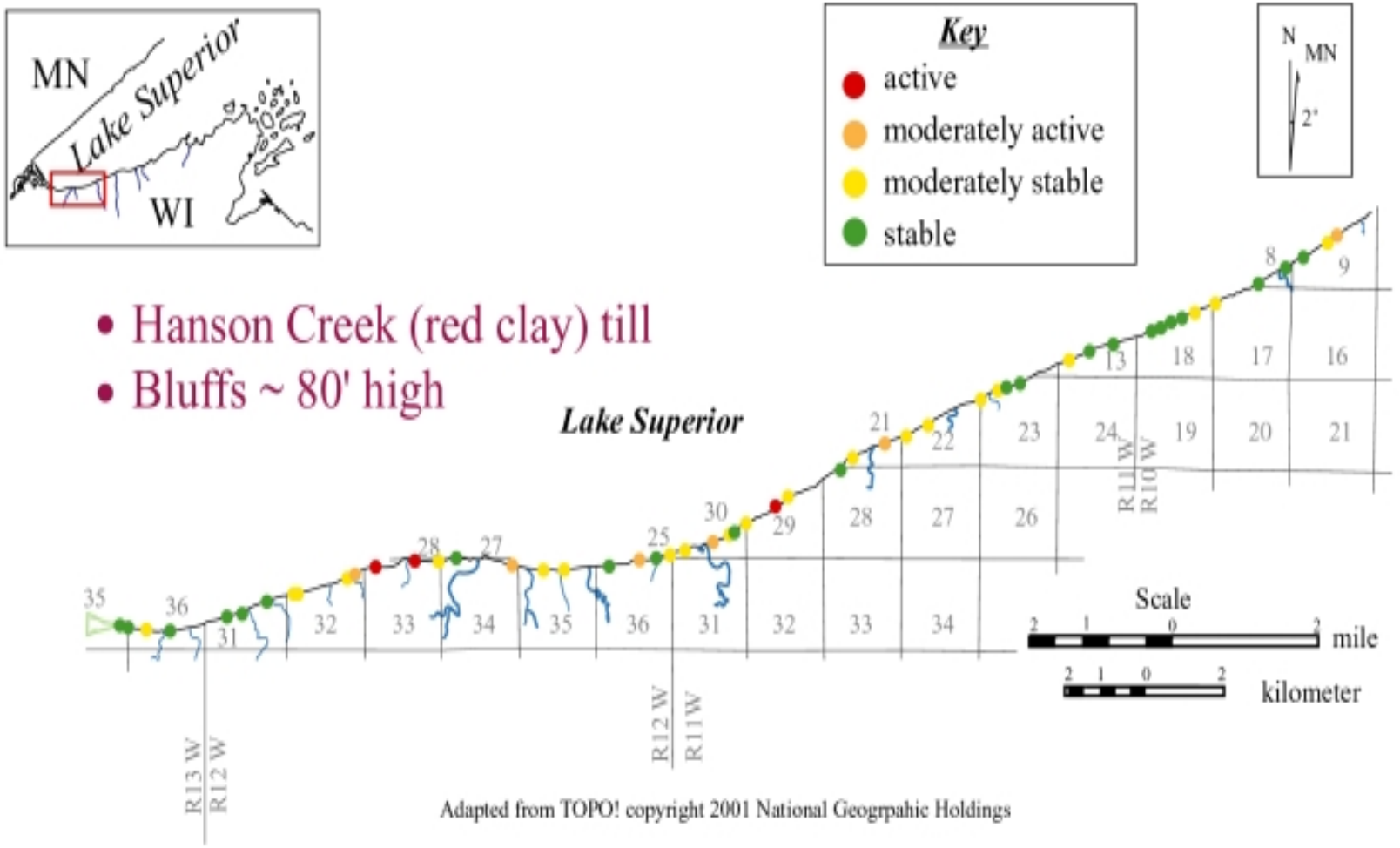
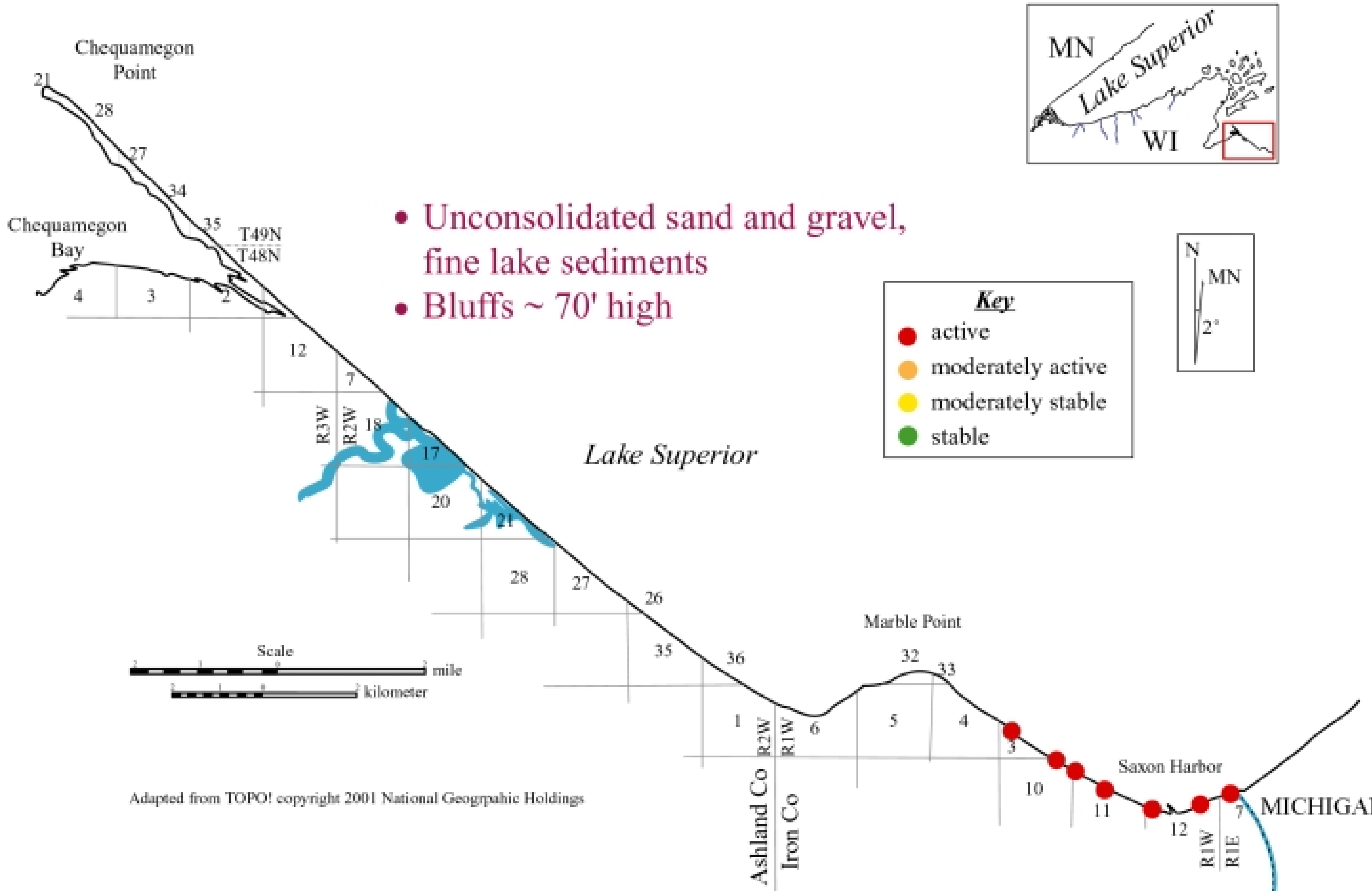
Reach 2


MN
Lake Superior
WI
Key
active
moderately active
moderately stable
stable
N
MN
2°
• Hanson Creek (red clay) till
• Bluffs ~ 80' high
Lake Superior
R13 W
R12 W
R11 W
R10 W
Scale
mile
kilometer
Adapted from TOPO! copyright 2001 National Geogrpahic Holdings


Reach 2

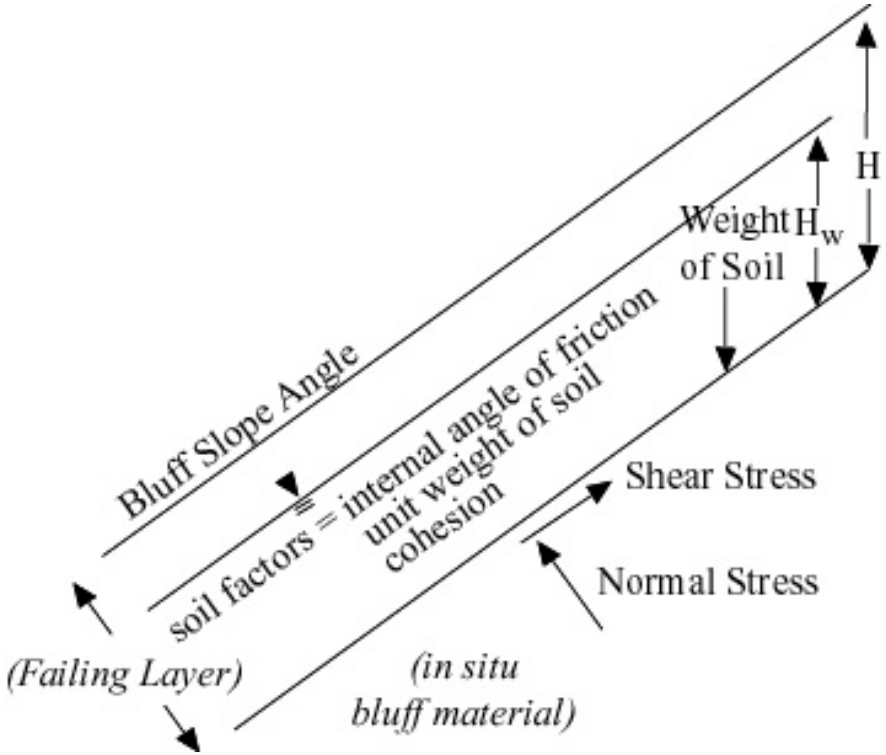
Reach 9

- Unconsolidated sand and gravel, fine lake sediments
- Bluffs ~ 70' high




Reach 9

Comparison



- **Compared field observations with analysis to look for trends in stability**

Beach/Nearshore Sand Thickness

- 8 Sites in Douglas and Bayfield Counties
- Beach/Nearshore characterized by thin layer of unconsolidated material (sand/gravel) over dense till
- Measured thickness of unconsolidated layer 4 times over one year

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Beach/Nearshore Sand Thickness-Results

- 7 of 8 sites had annual net sand volume loss
  - 48.52 ft^3 (14.75m^3)
- Sediment loss during Winter and Spring
- Sediment gain during summer and fall
  - »Showed similar results as previous studies (Rukavina, 1978 and Davis and Fox, 1975)

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Bluff Erosion-Rate Prediction

- **Predictors of bluff erosion are still unknown in detail, but Wave Impact Height appears to be a good measure of bluff erosion.**

Wave Impact Height (WIH)

- ***Definition*: Weighted measure of wave impact on bluff over time (calculated from wind and wave records)**
- ***Assumption*: If wave doesn't hit bluff, won't erode**
  - **WIH predicts frequency and magnitude of wave hitting bluff**
  - **WIH appears to correlate with recession rate**
    - **We will determine if WIH is a good predictor of bluff erosion.**